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(54) PROCESS FOR PRODUCING A GASEOUS CARBON DIOXIDE — TRI-ETHYLAMINE MIXTURE

(71) We, KOHLENSÄUREWERKE C. G. ROMMENHÖLLER G.m.b.H., of 3490 Bad Driburg-Herste, Federal Republic of Germany, a body corporate organised under the Laws of the Federal Republic of Germany,

do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method of and apparatus for producing a gaseous carbon dioxide-triethylamine mixture for the production of foundry moulds and cores.

According to the present invention a process for producing a gaseous carbon dioxide triethylamine mixture under pressure in a container, comprises the injection of liquid triethylamine through a nozzle into a vaporising device under a pressure of 2 Kp/cm² and metering during injection time, simultaneously introducing carbon dioxide into the vaporiser under a pressure of 5 Kp/cm² and at a temperature of 45°C, producing by turbulence a triethylamine-carbon dioxide vaporised gas mixture and conducting it into a mixing chamber after passing through a saturation area and reservoir area as a two component gas, adjusting the mixture ratio by the addition of carbon dioxide through a nozzle operating at the same time interval and pressure ratio as the injection nozzle for the triethylamine, and conducting the reaction gas through a condensation chamber and buffer zone to the outlet with compensation for temperature and pressure.

The apparatus for carrying out the above process comprises a housing with an injection nozzle for the liquid triethylamine in the base, nozzles for the carbon dioxide arranged to enter through the sides of the housing, a reservoir filter in said housing, a mixing cylinder in said housing, a compression spring above said filter and cylinder, said spring serving to secure said reservoir filter and mixing cylinder in position in said housing, said mixing cylinder containing one of the nozzles for carbon dioxide, another of said nozzles for carbon dioxide being disposed together with the nozzle for triethylamine in a portion of said housing serving as a turbulence chamber, a receptacle closed at each end by lids and connected to said housing, a second reservoir filter in said receptacle, an inlet for the reaction gas in one of said lids, and an outlet in the other lid.

The lower part of the housing may be fitted in its side wall with two injection nozzles for the carbon dioxide.

The lower part of the housing is constructed to form a turbulence chamber, whereas the part above the atomising nozzle may contain a saturation zone, a reservoir zone and a mixing chamber.

The receptacle which is connected to the housing to form an assembly unit therewith preferably contains a condensation chamber and a buffer zone. The housing and the receptacle may be detachably connected by tiebolts and nuts.

An embodiment in accordance with the invention will now be described by way of example and with reference to the accompanying drawings, in which:—

Fig. 1 is a longitudinal section of an apparatus according to the invention and

Fig. 2 is a schematic representation of a general functional layout of the apparatus.

With reference to Fig. 1, the apparatus for performing the method proposed by the invention substantially consists of a housing composed of a lower part 1 and an upper part in the form of a cylindrical receptacle 9. Both these parts are detachably connected by tiebolts 20 to form a unit assembly. At their upper ends of the tiebolts 20 are secured by cap nuts 21.

In the lower part 1 of the housing there are inserted an injection nozzle 2, a chamber member 3, a reservoir filter 4 and a mixing cylinder 5. The mixing cylinder 5 is surmounted by a compression spring 6 which keeps said chamber member 3 and said mixing cylinder 5 in position. The compression spring 6 is held in position by an

annular groove 7^{11} in the bottom 7 of the receptacle 9. Fitted into the side of the lower part 1 of the housing are an atomising nozzle 12 and a mixing nozzle 13. Both nozzles project into the interior of the lower part 1 of the housing.

The cylindrical receptacle 9 is closed at its top by a cover 8 and contains a further reservoir filter 10 and a pipe connector 11 for the withdrawal of the non-condensing reaction gas. The bottom 7 of the receptacle 9 has a central opening 7^{1} for the inflowing reaction gas.

The method proposed by the invention is directed to the combination of the two components carbon dioxide as a carrier and reaction gas and triethylamine as a catalyst, said combination being effected in the above-described apparatus. Carbon dioxide in gaseous form and triethylamine are introduced into the apparatus, by means of the nozzles 2, 12 and 13 which will be later described in more detail, and systems of chambers, and with due regard to temperature, the liquid component is changed from the liquid into the gaseous state.

The method proceeds as follows:—

Triethylamine is injected at a pressure of 2 kp/sq. cm through the injection nozzle 2 in the lower part 1 of the housing. The period of injection is between 1.5 and 2 seconds which determines the quantity of catalyst introduced. At the same time carbon dioxide is introduced at a pressure of 5 kp/sq. cm and at a temperature of 45°C through the nozzles 12 and 13 into the lower part 1 of the casing. Turbulence generated in a turbulence chamber 14 gives rise to the formation of a triethylamine-carbon dioxide-vapour-gas mixture which, after passing through a saturation zone 15 and a reservoir zone 16, enters a mixing chamber 17 in the form of a two-component gas. In the mixing chamber 17 the mixture proportions are adjusted by the addition of carbon dioxide through the mixing nozzle 13, the adjustment being operated by a throttle valve 24 in the supply system, for the same period and at the same pressure as the injection nozzle 2 for the liquid component. The reaction gas is introduced through the central opening 7^{1} into a condensation chamber 18 and a buffer zone 19, which serve to compensate temperature and pressure. The dry non-condensing two-component gas which can be withdrawn from the receptacle 9 through the pipe connector 11 serving as outlet for the reaction gas is taken direct to the core gassing equipment.

Magnetic valves 22 and 23 operate the injection nozzle 2, the atomising nozzle 12 and the mixing nozzle 13. The two magnetic valves 22 and 23 are simultaneously opened by a high speed coil under the control of a time delay relay. The magnetic valve 22 and the injection nozzle 2 remain open for 1.5 to 2 seconds, whereas the magnetic valve 23, the atomising nozzle 12 and the mixing nozzle 13 remain in operation for 7 seconds.

WHAT WE CLAIM IS:—

1. Process for producing a gaseous carbon dioxide-triethylamine mixture under pressure in a container, comprising the injection of liquid triethylamine through a nozzle into a vaporising device under a pressure of 2 kp/cm² and metering during injection time, simultaneously introducing carbon dioxide into the vaporiser under a pressure of 5 kp/cm² and at a temperature of 45°C, producing by turbulence a triethylamine-carbon dioxide vaporised gas mixture and conducting it into a mixing chamber after passing through a saturation area and reservoir area as a two component gas, adjusting the mixture ratio by the addition of carbon dioxide through a nozzle operating at the same time interval and pressure ratio as the injection nozzle for the triethylamine, and conducting the reaction gas through a condensation chamber and buffer zone to the outlet with compensation for temperature and pressure.

2. Apparatus, for carrying out the process of claim 1, comprising a housing with an injection nozzle for the liquid triethylamine in the base, nozzles for the carbon dioxide arranged to enter through the sides of the housing, a reservoir filter in said housing, a mixing cylinder in said housing, a compression spring above said filter and cylinder, said spring serving to secure said reservoir filter and mixing cylinder in position in said housing, said mixing cylinder containing one of the nozzles for carbon dioxide, another of said nozzles for carbon dioxide being disposed together with the nozzle for triethylamine in a portion of said housing serving as a turbulence chamber, a receptacle closed at each end by lids and connected to said housing, a second reservoir filter in said receptacle, an inlet for the reaction gas in one of said lids, and an outlet in the other lid.

3. Apparatus, as claimed in claim 2, wherein a saturation zone, a reservoir zone, and a mixing chamber are provided between said nozzles, supplying carbon dioxide, which penetrate into the inside of the housing.

4. Apparatus, as claimed in either of claims 2 and 3, wherein said receptacle includes a condensation chamber and a buffer zone.

5. Apparatus, as claimed in any one of claims 2 to 4, wherein the housing is detachably connected to said receptacle by tie-bolts and nuts and forms an assembly unit therewith.

6. Process for producing a gaseous carbon dioxide-triethylamine mixture substan-

tially as described herein with reference to the accompanying drawings.

7. Apparatus for carrying out the process of claim 1, substantially as described herein with reference to and as illustrated by the accompanying drawings.

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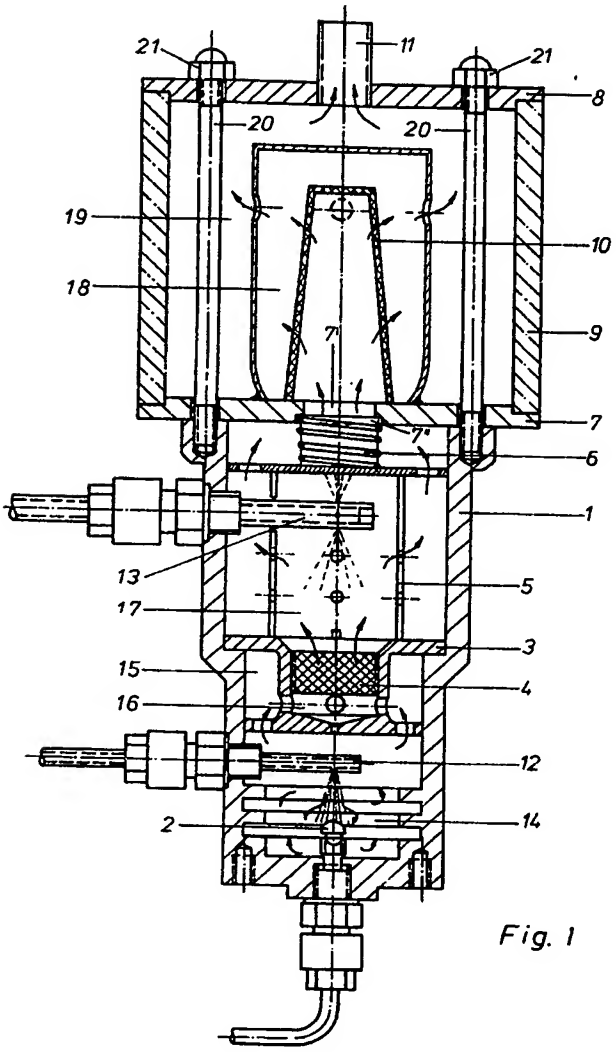

Fig. 1

1402355 COMPLETE SPECIFICATION
2 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 2

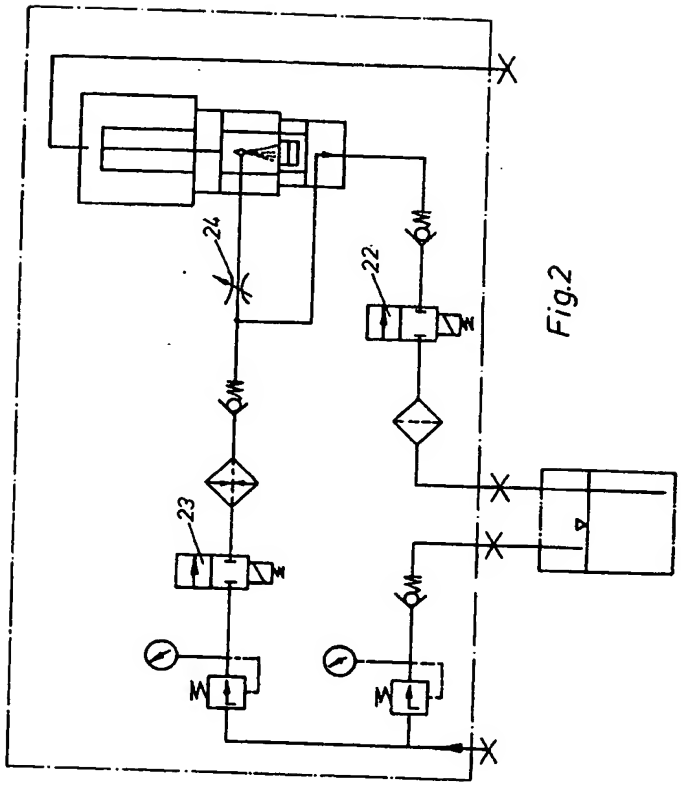

Fig.2